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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Evangelos Laskaris et al.

Serial No.: 10/065,848

Filed: November 25, 2002

For: COLD MASS SUPPORT
STRUCTURE AND HELIUM
VESSEL OF ACTIVELY SHIELDED
HIGH FIELD OPEN MRI MAGNETS

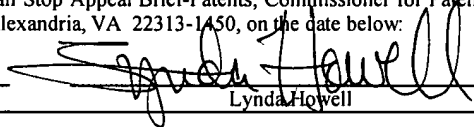
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Group Art Unit: 2859

Examiner: Tiffany A. Fetzner

Atty. Docket: RD28742-1/YOD
GERD:0128

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| October 7, 2005 |  |
| Date | Lynda Howell |

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on June 1, 2005, and received by the Patent Office on June 7, 2005.

The Commissioner is authorized to charge the requisite fee of \$500.00, and any additional fees which may be necessary to advance prosecution of the present application, to Account No. 07-0868, Order No. RD28742-1/YOD (GERD:0128).

Appellants hereby request a two (2) month extension in the statutory period for submission of the Appeal Brief, from August 7, 2005 to October 7, 2005, in accordance with 37 C.F.R. § 1.136. The Commissioner is authorized to charge the requisite fee of \$450.00, and any other fee that may be required, to Deposit Account No. 07-0868; Order No. RD28742-1/YOD (GERD:0128).

1. **REAL PARTY IN INTEREST**

The real party in interest is General Electric Company, the Assignee of the above-referenced application by virtue of the Assignment to General Electric Company by Evangelos Laskaris, Xianrui Huang, Michele D. Ogle, Michael A. Palmo and Paul S. Thompson, recorded at reel 013264, frame 0420, and dated November 25, 2002. Accordingly, General Electric Company will be directly affected by the Board's decision in the pending appeal.

2. **RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1-23 are currently pending, are currently under final rejection and, thus, are the subject of this Appeal.

4. **STATUS OF AMENDMENTS**

Appellants have not submitted any amendments subsequent to the Final Office Action mailed on January 11, 2005.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

The present invention relates generally to the field of magnetic resonance imaging (MRI) devices with a single unit support structure. *See* Application page 1, line 1-2. More particularly, in certain embodiments, the invention relates to MRI devices with at least one shaping coil to shape a magnetic field for imaging a volume and MRI devices with a single unit support structure. *See id.* at page 1, line 3-4.

The Application contains 4 independent claims, namely, claims 1, 17, 20 and 23, all of which are the subject of this Appeal. The subject matter of these claims is summarized below.

With regard to the aspect of the invention set forth in independent claim 1, discussions of the recited features of claim 1 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present invention relates to an open magnetic resonance imaging (MRI) device (e.g., 100) comprising a main coil (e.g., 110) for generating a magnetic field for imaging a volume. *See, e.g., id.* at page 5, paragraph 0020; *see also* FIG. 1. The MRI device also includes a plurality of shaping coils (e.g., 150) positioned radially inside said main coil and axially further from the volume than the main coil or in a plane of the main coil to shape the magnetic field in said volume. *See, e.g., id.* at page 9, paragraph 0030; *see also* FIG. 1.

With regard to the aspect of the invention set forth in independent claim 17, discussions of the recited features of claim 17 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present invention relates to a magnetic resonance imaging (MRI) apparatus (e.g., 100) for imaging a volume comprising at least one main coil (e.g., 110) configured to generate a magnetic field and at least one bucking coil (e.g., 120) disposed axially outside the at least one coil with respect to the volume and configured to shield the at least one coil. *See, e.g., id.* at page 5, paragraphs 0020 and 0021; *see also* FIG. 1. The MRI apparatus also includes a plurality of shaping coils (e.g., 150) to shape the magnetic field in the volume. *See, e.g., id.* at page 9, paragraph 0030; *see also* FIG. 1.

With regard to the aspect of the invention set forth in independent claim 20, discussions of the recited features of claim 20 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present invention relates to a magnetic resonance imaging (MRI) apparatus (e.g., 100) for imaging a volume comprising means for generating a magnetic field for imaging the volume and means for shielding the means for generating. *See, e.g., id.* at page 5, paragraphs 002 and 0021; *see also* FIG. 1. The MRI apparatus also includes means for shaping the magnetic field positioned radially inside the means for

generating the magnetic field and axially further from the volume than the means for generating the magnetic field or in a plane of the means for generating the magnetic field. *See, e.g., id.* at page 9, paragraph 0030; *see also* FIG. 1.

With regard to the aspect of the invention set forth in independent claim 23, discussions of the recited features of claim 23 can be found at least in the below cited locations of the specification and drawings. By way of example, an embodiment in accordance with the present invention relates to an open magnetic resonance imaging (MRI) device comprising first and second main coils (e.g., 110, 115) for generating a magnetic field for imaging a volume. *See, e.g., id.* at page 5, paragraph 0020; *see also* FIG. 1. The MRI device also includes first and second sets of shaping coils (e.g., 150, 153) positioned adjacent to each of the first and second main coils, respectively, each set of shaping coils being positioned radially within the respective main coil and axially further from the volume than the respective main coil or in a plane of the respective main coil to shape the magnetic field in the volume. *See, e.g., id.* at page 9, paragraph 0030; *see also* FIG. 1.

A benefit of the invention, as recited in these claims, is the ability to shape magnetic field in a volume by a plurality of shaping coils positioned radially inside a main coil of an MRI device. As described in the specification, the use of multiple shaping coils allows for the designer to have improved uniformity in the magnetic field. *See, e.g., id.* at page 9, paragraph 0032.

This is a clear difference and distinction from the prior art, as discussed below.

6. **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

First Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's first ground of rejection in which the Examiner rejected claims 1, 12, 13 and 16 under 35 U.S.C. § 102(b) as being anticipated by U.S. patent no. 5,307,039 (hereinafter "Chari").

Second Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's second ground of rejection in which the Examiner rejected claims 1-12 and 14-23 under 35 U.S.C. § 102(b) as being anticipated by U.S. patent no. 6,211,676 B1 (hereinafter "Byrne")

Third Ground of Rejection for Review on Appeal:

Appellants respectfully urge the Board to review and reverse the Examiner's third ground of rejection in which the Examiner rejected claims 12 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Chari.

7. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Sections 102 and 103. Accordingly, Appellants respectfully request full and favorable consideration by the Board, and reversal of the outstanding rejections.

A. **Ground of Rejection No. 1:**

The Examiner rejected claims 1, 2, 13 and 16 under 35 U.S.C. § 102(b) as being unpatentable over Chari. Independent claim 1 will be discussed below. Appellants respectfully traverse this rejection.

1. **Judicial precedent has clearly established a legal standard for an anticipation rejection.**

Anticipation under Section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed. Cir. 1985). Thus, for a prior art reference to anticipate under Section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). Moreover, the prior art reference also must show the

identical invention “*in as complete detail as contained in the claim*” to support a rejection for anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Accordingly, Appellants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter.

Moreover, it is axiomatic that the Examiner should give claims under examination their broadest reasonable interpretation. However, that standard itself turns on whether the interpretation made by the Examiner is “reasonable.” If that fundamental threshold issue is questionable, the very basis for the rejection of the claims is jeopardized. Appellants submit that, in the present case, the Examiner has based the rejections upon an unreasonable interpretation of the claims, and has thus misapplied prior art teachings to reach a conclusion of anticipation.

2. **The Examiner’s rejection of independent claim 1 is improper because the rejection fails to establish a *prima facie* case of anticipation.**

Independent claim 1 recites:

An open magnetic resonance imaging (MRI) device,
comprising:

a main coil for generating a magnetic field for
imaging a volume; and

a plurality of shaping coils positioned radially inside
said main coil and axially further from said volume than said
main coil or in a plane of said main coil to shape said
magnetic field in said volume.

a. **Claim 1 requires “main coils” and “shaping coils”.**

The invention recited in the application includes a main coil for generating a magnetic field for imaging a volume and a plurality of shaping coils to shape the magnetic field in the volume.

As stated in MPEP § 2111, during patent examination, the claims must be given their broadest reasonable interpretation consistent with the specification. The broadest

reasonable interpretation of the claims must be consistent with the interpretation that those skilled in the art would reach. The Examiner essentially asserted that meaning of the claimed “shaping coils” is definitionally unclear because any MRI coil that shapes, shims, controls or helps to make the main static magnetic field more homogenous, uniform, consistent, or constant throughout the imaging volume by minimizing magnetic field fluctuations or induced eddy currents is effectively a magnetic field “shaping coil”. However, the Examiner presented no basis or reference for this definition. Indeed, the Examiner’s interpretation is so broad as to essentially qualify *any* structure that would influence the field of a main MRI coil as shaping coil. That interpretation is *unreasonably broad*, and inconsistent with the meaning that would be attributed by those skilled in the art.

Appellants submit that “main coils” in MRI systems function to generate magnetic field for imaging a volume. The main coils are coupled to an electrical power source for passing a current through the main coils, thereby ramping up the magnetic field for imaging a volume. *See, e.g.*, Application at page 5, paragraph 20. Furthermore, “shaping coils” function to improve the accuracy of the MRI device by shaping the magnetic field generated by the main coils in the volume to be imaged. *See, e.g., id.* at page 9, paragraph 32.

Appellants assert that the main coils and shaping coils are mutually exclusive elements and are configured to perform different functions. As will be appreciated by those skilled in the art, it is physically impossible and illogical for an imaging system to have coils that function as either or both main and shaping coils. Even if prior art teaches the main coils and shaping coils they do not have the spatial relationship as described in the present invention.

b. Chari disclosed only *main coils*.

In rejecting independent claim 1, the Examiner asserted that Chari teaches all of the recited features of the claim. *See* Final office Action mailed January, 11, 2004 page 2. Chari discloses a magnet having a series of coils, referenced by numerals 24 through 28 as a part of the main magnet. *See*, Chari, col. 3 lines 8-14; *see also* FIG. 2. Further, the coils are spaced along the longitudinal axis of the bore in order of progressively increasing diameter.

Chari, in fact, teaches a system in which multiple main coils are provided within a surrounding structure that clearly implies that they are main coils. The structure, visible in figure 3 of Chari, is referred to as a vacuum vessel 30, in which the coils are bathed in a cryogenic fluid to maintain their superconductivity. Appellants contend that those skilled in the art of MRI system construction would readily understand from Chari that when coils are positioned within a vacuum vessel, and are specifically designated as superconducting, those coils are not “shaping coils” but are “main coils”. Indeed, the Chari reference itself never mentions any other term or purpose for coils 24 through 28 than “main coil”.

b. The Examiner’s interpretation *certain* of Chari’s “*main coils*” as “*shaping coils*” is unreasonable.

The Examiner would have certain of these coils qualified as “main coils” and others as “shaping coils”. According to the Examiner, the very coils described by Chari as “main coils” could and should be called “shaping coils”. Indeed, there would be no reason whatsoever for such *renaming* of the coils by function except to formulate the rejection of claim 1—to satisfy the placement and geometry recitations of the claim. That is, there is no reason whatsoever for qualifying coils to the left in figure 3 of Chari as “main coils” and those to the right as “shaping coils” except to satisfy the requirements of the claim. One skilled in the art would just as readily call the right-hand coils “main coils” and the left-hand coils “shaping coils”, in which case the remaining recitations of

the claim would not be satisfied. There is no basis in the reference for such selective interpretation of the claim terms, or of the reference teachings.

Appellants therefore submit that the Examiner's interpretation of claim 1 is unreasonable, as is, therefore the application of the teachings of Chari. For these reasons, Appellants ask the Board to reverse the Examiner's rejection of claim 1, as well as the claims that depend therefrom.

B. **Ground of Rejection No. 2:**

The Examiner rejected claims 1-12 and 14-23 under 35 U.S.C. § 102(b) as being anticipated by Byrne. This rejection affects all of the independent claims 1, 17, 20 and 23.

1. **Judicial precedent has clearly established a legal standard for an anticipation rejection.**

The legal bases for an anticipation rejection are summarized above. Appellants would have the Board, again, consider particularly the requirement that the Examiner's interpretation of the claims (and the prior art) be *reasonable*.

2. **Claims 1, 17, 20 and 23 all recite "main coils" and "shaping coils", or equivalent structures.**

Independent claim 1 recites:

An open magnetic resonance imaging (MRI) device,
comprising:

a main coil for generating a magnetic field for
imaging a volume; and

a plurality of shaping coils positioned radially inside
said main coil and axially further from said volume than said
main coil or in a plane of said main coil to shape said
magnetic field in said volume. (Emphasis added.)

Independent claim 17 recites:

A magnetic resonance imaging (MRI) apparatus,
comprising:
at least one *main coil* configured to generate a
magnetic field;
at least one *bucking coil* disposed axially outside said
at least one main coil with respect to said volume and
configured to shield said at least one main coil;
a plurality of *shaping coils* to shape said magnetic
field in said volume; and
a plurality of ferromagnetic rings for shielding
interactions between coils of opposite polarity, at least one of
said plurality of ferromagnetic rings being positioned
between said at least one main coil and said at least one
bucking coil. (Emphasis added.)

Independent claim 20 recites:

A magnetic resonance imaging (MRI) apparatus for
imaging a volume, comprising:
means for generating a magnetic field for imaging
said volume;
means for shielding said means for generating; and
means for shaping said magnetic field positioned
radially inside the said means for generating the magnetic
field and axially further from said volume than said means
for generating the magnetic field or in a plane of said means
for generating the magnetic field. (Emphasis added.)

Independent claim 23 recites:

An open magnetic resonance imaging (MRI) device,
comprising:
first and second *main coils* for generating a magnetic
field for imaging a volume; and
first and second sets of *shaping coils* positioned
adjacent to each of said first and second main coils,
respectively, each set of shaping coils being positioned
radially within the respective main coil and axially further
from said volume than said respective main coil or in a plane
of said respective main coil to shape said magnetic field in
said volume. (Emphasis added.)

a. **Byrne fails to anticipate an open MRI device having shaping coils.**

With regard to independent claims 1, 17, 20 and 23, the Examiner asserted that Byrne teaches all of the recited features of the claim. *See*, Final Office Action mailed January, 11, 2004, page 3. Byrne discloses a C-shaped open electromagnet for use in an MRI system. The electromagnet includes “poles” 1 and 2, also referred to as “field coils” for generating a magnetic field, and a plurality of “shielding coils” 5, that may be connected in series so that the imaging magnetic field and the shielding magnetic field are generated by the same current. *See*, Byrne, col. 2 lines 30-45; *see also* FIGS. 1 and 2. Byrne also describes “iron rings” 2a, 2b, etc., that are not actual coils, but that are associated with the poles.

Byrne does not disclose or discuss the MRI device having shaping coils. As would be appreciated by those skilled in the art, “shaping coils” and “shielding coils” are inherently different structures having entirely different functions in an MRI device. The shaping coils, typically, are used to shape the magnetic field from the main coils and to create a homogenous magnetic field. However, shielding coils in an MRI device are used to shield the imaged area from external electromagnetic induction (i.e., “shield”) and also to prevent loss of the magnetic field around the imaged area.

b. **The Examiner’s interpretation Byrne’s “shielding coils” as “shaping coils” is unreasonable.**

In the Final Office Action, the Examiner suggested that the components identified as “shielding coils” are also, or could be considered “shaping coils”. Appellants submit that, as noted above, the main coils and shaping coils are mutually exclusive elements and are configured to perform different functions. Further, Appellants submit that Byrne only discloses field coils, shielding coils and iron rings for an open MRI device. Appellants further submit that those skilled in the art would clearly interpret Byrne’s “field coils” as “main coils”, but would not equate Byrne’s “shielding coils” as “shaping coils”.

Nothing in Byrne or in any other art presented by the Examiner supports the Examiner's interpretation of the claimed "shaping coils" as the equivalent to Byrne's "shielding coils" or vice versa. In particular, particularly in view of the different functions of such coils in MRI systems, Appellants can only conclude that the Examiner has improperly extended the conventional notion of "shaping coils" to encompass coils that shield the MRI system externally. The only basis for such an interpretation is the improper rejection of claims 1, 17, 20 and 23. No basis can be found in the art itself. Absent some showing of such shaping coils in Byrne, the reference simply cannot anticipate the present claims. For this reason, Appellants respectfully request that the Board reverse the rejection of claims 1, 17, 20 and 23, as well as the claims that depend therefrom.

c. **Claim 17 also recites "bucking coils" in a particular positioning not taught by Byrne.**

In addition to a "main coil" and a "shaping coil", claim 17 recites a "bucking coil". As set forth in the specification, the bucking coils are provided relative to the main coils to shield external devices from the fringe magnetic field generated by the main coils. The bucking coils are coupled to an electrical power source for passing a current through the bucking coils, thereby generating a shielding magnetic field for shielding the main coils. *See, e.g.*, Application at page 5, paragraph 21.

No structure taught by Byrne corresponds to such bucking coils placed as claimed. In particular, the shielding coils 5 of Byrne are not uniformly placed axially with respect the main coils (field coils 1 and 2) as recited in claim 17. Moreover, even if Byrne's shielding coils were considered to perform a function similar to the claimed bucking coils, such interpretation would reinforce the exclusion of Byrne's shielding coils from the definition of "shaping coils" discussed above. That is, claim 17 recites three different types of coils with three different functions in the system. Byrne only discloses two different types of coils. There would be no reasonable basis for selectively

reclassifying Byrne's coils as "main", "shaping" and "bucking" coils simply to support a rejection of claim 17.

Accordingly, Appellants respectfully request that the Board reverse the rejection of claim 17 on this basis as well.

C. **Ground of Rejection No. 3:**

Appellants respectfully urge the Board to review and reverse Examiner's third ground of rejection in which the Examiner rejected claims 12 and 14 under 35 U.S.C. § 103(a) as being rendered obvious over Chari.

1. **Judicial precedent has clearly established a legal standard for a *prima facie* obviousness rejection.**

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). For a single-reference obviousness rejection, such as that formulated by the Examiner, as for a rejection based on a combination of references, all of the elements of the rejected claims must be present in the reference, and there must be some reasonable basis for modifying the prior art structure to meet the recitations of the rejected claims. *See, e.g.*, MPEP 706.02(j).

2. **Claims 12 and 14 are patentable at least by virtue of their dependency from claim 1.**

Each of claims 12 and 14 depends from independent claim 1. Moreover, each of the Examiner's obviousness rejections is founded upon Chari, which is also discussed above. With this in mind, Appellants respectfully assert that it would not have been obvious to one of ordinary skill in the art at the time that the invention was made to modify Chari in such a way as to read on claim 1, and *a fortiori*, claims 12 and 14. Accordingly, Appellants respectfully assert that the instant claims are not only patentable

for their respective dependency on allowable base claim, but also by virtue of the additional features recited therein.


In light of the foregoing remarks, Appellants respectfully request that the Board withdraw the obviousness rejections in relation to claims 12 and 14.

Conclusion

Appellants respectfully submit that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: 10/7/2005



David M. Hoffman

Reg. No. 54,174

FLETCHER YODER

P.O. Box 692289

Houston, TX 77269-2289

(281) 970-4545

8. **APPENDIX OF CLAIMS ON APPEAL**

Listing of Claims:

1. An open magnetic resonance imaging (MRI) device, comprising:
a main coil for generating a magnetic field for imaging a volume; and
a plurality of shaping coils, positioned radially inside said main coil or axially further from said volume than said main coil or in a plane of said main coil to shape said magnetic field in said volume.
2. The open MRI device of claim 1, further comprising:
a single unit support structure,
wherein said main coil is positioned on an outer surface of said single unit support structure, and
wherein at least one of said shaping coils is positioned on an inner surface of said single unit support structure.
3. The open MRI device of claim 2, wherein said single unit support structure comprises:
a substantially cylindrical shell;
a hub positioned along a substantially central axis of said cylindrical shell; and
a plurality of gussets positioned within said cylindrical shell, each of said gussets extending radially outward from said hub.
4. The open MRI device of claim 3, wherein said single unit support structure further comprises:
at least one support post positioned between a first half and a second half of said cylindrical shell.

5. The open MRI device of claim 4, wherein said at least one support post is attached on one end to a flange formed on the first half of said cylindrical shell and attached on an opposite end to a flange formed on the second half of said cylindrical shell.

6. The open MRI device of claim 3, wherein at least one of:
said cylindrical shell, said hub, and said gussets comprise one of stainless steel, aluminum, and fiber-reinforced composites.

7. The open MRI device of claim 2, further comprising:
at least one ferromagnetic ring positioned on an outer surface of said single unit support structure.

8. The open MRI device of claim 7, wherein said at least one ferromagnetic ring is positioned substantially between coils having opposite current directions to shield interactions between the coils having opposite current directions.

9. The open MRI device of claim 7, wherein said MRI device comprises at least four ferromagnetic rings.

10. The open MRI device of claim 2, further comprising:
at least one bucking coil positioned on an outer surface of said single unit support structure for shielding the magnetic field.

11. The open MRI device of claim 10, wherein said MRI device comprises at least two bucking coils.

12. The open MRI device of claim 1, wherein said MRI device comprises at least eight shaping coils.

13. The open MRI device of claim 1, wherein said at least one of said shaping coil shapes said magnetic field in said volume to a uniformity of at least 10 ppm.

14. The open MRI device of claim 1, wherein said MRI device comprises an even number of shaping coils.

15. The open MRI device of claim 14, wherein a first half of the number of shaping coils have a first magnetic polarity and a second half of the number of shaping coils have a second magnetic polarity substantially opposite that of said first magnetic polarity.

16. The open MRI device of claim 1, wherein said MRI device comprises a plurality of shaping coils, at least one of said plurality of shaping coils having a magnetic polarity opposite to a magnetic polarity of another of said plurality of shaping coils.

17. A magnetic resonance imaging (MRI) apparatus for imaging a volume, comprising:

at least one main coil configured to generate a magnetic field;

at least one bucking coil disposed axially outside said at least one main coil with respect to said volume and configured to shield said at least one main coil;

a plurality of shaping coils to shape said magnetic field in said volume; and

a plurality of ferromagnetic rings for shielding interactions between coils of opposite polarity, at least one of said plurality of ferromagnetic rings being positioned between said at least one main coil and said at least one bucking coil.

18. The MRI apparatus of claim 17, further comprising:

a single unit support structure for supporting said at least one main coil, said at least one bucking coil, said plurality of shaping coils, and said plurality of ferromagnetic rings.

19. The MRI apparatus of claim 18, wherein said single unit support structure comprises:

a substantially cylindrical shell;
a hub positioned along a substantially central axis of said cylindrical shell; and
a plurality of gussets positioned within said cylindrical shell, each of said gussets extending radially outward from said hub.

20. A magnetic resonance imaging (MRI) apparatus for imaging a volume, comprising:

means for generating a magnetic field for imaging said volume;
means for shielding said means for generating; and
means for shaping said magnetic field positioned radially inside the said means for generating the magnetic field and axially further from said volume than said means for generating the magnetic field or in a plane of said means for generating the magnetic field.

21. The MRI apparatus of claim 20, further comprising:
means for supporting said means for generating, said means for shielding, and said means for shaping.

22. The MRI apparatus of claim 20, further comprising:
means for shielding interactions between coils of opposite polarity.

23. An open magnetic resonance imaging (MRI) device, comprising:
first and second main coils for generating a magnetic field for imaging a volume;
and
first and second sets of shaping coils positioned adjacent to each of said first and second main coils, respectively, each set of shaping coils being positioned radially within the respective main coil and axially further from said volume than said respective main coil or in a plane of said respective main coil to shape said magnetic field in said volume.

9. **APPENDIX OF EVIDENCE**

None.

10. **APPENDIX OF RELATED PROCEEDINGS**

None.